NON-PUBLIC?: N
ACCESSION #: 9506130312
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Zion Unit 2 PAGE: 1 OF 05

DOCKET NUMBER: 05000304

TITLE: Negative Flux Rate Reactor Trip From Dropped Control Rod
Due to Procedureal Deficiency in Rod Control System
Urgent Alarm Annunciator Response
EVENT DATE: 10/08/88 LER #: 88-007-01 REPORT DATE: 06/09/95

OTHER FACILITIES INVOLVED: Zion Unit 1 DOCKET NO: 05000295

OPERATING MODE: 1 POWER LEVEL: 056

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: John Parker, System Engineering TELEPHONE: (708) 746-2084
ext. 2300

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: AA COMPONENT: FU MANUFACTURER: S156
X AA OSL W351
X AA ECBD W351
X AA FU B569
REPORTABLE NPRDS: Y
N
Y
Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 10/08/88, Unit 2 operators were performing Periodic Test (PT)-1, "Rod Control Cluster Exercise" AA!. This test involves stepping each bank of control rods into and out of the core in order to verify proper rod operation. When the unit operators received an Urgent Failure Alarm from the control rod circuitry, investigation found a blown fuse indicator in the SCD cabinet, When the operators attempted to replace this fuse, the Unit 2 reactor tripped.

The cause of the reactor trip was procedural deficiency. The cause of the Rod Control System Urgent Failure annunciator was component failure. All safety systems responded as designed.

Corrective actions included analyzing all failed components to determine the mode of failure, and revising Operating procedures to require System Engineering concurrence before removing fuses from rod control cabinets.

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END OF ABSTRACT



A. CONDITION PRIOR TO EVENT

MODE 1 - Power Operation RX Power - 56% RCS AB! Temperature/Pressure 550 degrees F/2235psig

B. DESCRIPTION OF EVENT

At approximately 0200 hours on October 08, 1988, Unit 2 operators were performing Periodic Test (PT)-1, "Rod Control Cluster Exercise" AA!. This test involves stepping each bank of control rods into and out of the core in order to verify proper rod operation. When rod motion was attempted for Shutdown Bank A, the "Rod Control System Urgent Failure" annunciator alarm was received in the control room. Operating personnel dispatched to the Auxiliary Electric Room, found the urgent alarm lamp lit on Rod Control Power Cabinet 1AC. This cabinet controls power to Group 1 of the Shutdown Bank A rods. Inspection of the card edge failure lights in cabinet 1AC indicated that the alarm was due to a phase failure. Phase failures are due to abnormally high ripple current, indicative of a missing phase. The local alarm reset push-button in cabinet 1AC was depressed and the urgent alarm cleared. No other abnormalities in the power cabinets were noted at this time.

PT-1 was continued, stepping Shutdown Bank A rods, and then Shutdown Bank B rods with no further problems. When motion of Shutdown Bank C was attempted, a "Rod Control System Urgent Failure" annunciator alarm was again received. This time, when an operator was dispatched to the Auxiliary Electric Room, an urgent alarm lamp was found illuminated on Power Cabinet SCD. Cabinet SCD powers the rod motion of Shutdown Banks C and D. Inspection of the cabinet card edge lights indicated that the alarm was due to a logic error.

Logic errors are caused when zero current is demanded for movable and stationary gripper coils simultaneously. The movable and stationary gripper coils serve to hold the control rods out of the reactor core, thus zero current to both at the same time could result in dropped rods. The local alarm reset push-button was depressed, but the alarm would not clear. At this time, it was noticed that a blown fuse indicator had "popped" for fuse FU-14 in cabinet SCD. FU-14 is for the stationary gripper coils on control rod C-11. Failure or removal of this fuse would result in those coils being de-energized. The blown fuse indicator was replaced, and did not "pop" to indicate a failed fuse. Voltage readings were taken across fuse FU-14, as well as across neighboring fuses, with results of 180 millivolts for FU-14 and approximately 0 volts for the others. Operators felt that these readings were evidence that the fuse had failed and decided to replace it. Fuse FU-14 was pulled, and the Reactor tripped on negative flux rate signals from Nuclear Instrumentation channels 42 and 43. The time of the trip was 0355 on October 08, 1988.



B. DESCRIPTION OF EVENT (Continued)

After the reactor trip, the following abnormal conditions were found in the rod control cabinets:

Blown fuse indicators were "popped" for one phase of the Stationary Coil 30 Amp fuses in each of power cabinets 1AC and 2AC.

The SCD Oscillator failure indicator lamp was illuminated in the logic cabinet. The Oscillator provides timing signals to the rod control system.

The two stationary coil phase fuses with "popped" indicators were removed and checked for continuity; both appeared to be good. As a precautionary measure, these fuses were replaced with new fuses and new blown fuse indicators.

The SCD Pulser/Oscillator circuit card was replaced and tested for proper output. After all alarms were reset, control rods were checked for proper operation by stepping each bank in and out five steps; all operated properly. The reactor was subsequently brought back to power until shutdown for refueling on October 12, 1988.

Further investigation was performed on October 14, following the reactor shutdown, to verify if a logic error in power cabinet SCD would create an urgent alarm, as reported by the unit operators. A power cabinet urgent alarm automatically sends reduced current signals to all the stationary grippers associated with that cabinet, as well as to the movable grippers of the selected bank, which in this case, was Shutdown Bank C. With current to both sets of grippers, rod C-11 should not have fallen into the core when current was removed from the stationary grippers alone, since it was also being held by the movable grippers. Examination of Power Cabinet SCD revealed that pushing the cabinet alarm reset push-button would clear the Urgent Alarm in that cabinet, but would not clear the logic error indication. It was determined that the Alarm Circuitry Card in SCD had failed in such a manner as to give a false logic error indication. The card was removed for further analysis.



C. APPARENT CAUSE OF EVENT

The cause of the reactor trip was procedural deficiency. Immediate Action 4 of the Annunciator Response Manual for Panel 8, W ndow 7A
(Rod Control System Urgent Failure) directs the operator to "check blown fuse indicators and replace fuses if necessary". Thus, there are no restrictions on removing fuses. The measurement of voltages across FU-14 and its neighbors led operators to believe that the fuse had failed, and that prudent action was to replace the fuse. The operators had no immediate means of knowing that 0 to 180 millivolts is a normal reading across those fuses and that, as the newly installed indicator suggested, FU-14 had not failed. It was also unknown by the operators that FU-14 was a fuse for stationary gripper coils which, at that time, were the only provision for holding rod C-11 out of the core. When the fuse was pulled, the stationary grippers de-energized and the rod dropped into the core. Enough negative reactivity was injected to cause a rate trip on the two nearest Nuclear Instrumentation Channels.

The cause of the Urgent Alarm and Phase Failure indication in Cabinet 1AC is unknown. It is possible that a momentary low voltage spike caused the cabinet circuitry to sense a phase failure. This spike may also have caused the blown fuse indications in cabinets 1AC and 2AC.

The cause of the Rod Control System Urgent Failure annunciator was a combination of component failures. The SCD Oscillator failed, giving an urgent alarm from the Rod Control Logic Cabinet. At the same time, a logic error was indicated for the SCD Power Cabinet due to the failed Alarm Circuit Card. When operators inspected the cabinets, they interpreted the alarm as originating from Power Cabinet SCD. This interpretation may have been influenced by the previous urgent alarm that had been received in Power Cabinet 1AC. When the Power Cabinet Alarm Reset Push-button was depressed, it would have cleared the urgent alarm, but did not clear the logic error indication from the failed Alarm Circuit Card. Operators then proceeded to look for further causes of failure, and discovered the blown fuse indicator on fuse FU-14.

D. SAFETY ANALYSIS OF EVENT

No safety consequences resulted from this event. The reactor retained its ability to trip, as demonstrated, despite faults in the Rod Control System. Zion Technical Specifications require that coincidence of two Nuclear Instrumentation Channels sensing a negative flux rate (5% rated flux decrease/2 seconds) trip the reactor. The two closest channels, N42 and N43, sensed the rate of change in flux as rod C-11 dropped, and the system responded as expected.





E. CORRECTIVE ACTIONS

1. Operating Procedure AOP 2.1, Appendix B was revised to require operators to obtain System Engineering assistance prior to attempting to correct rod control problems.

2. All fuses and blown fuse indicators that were removed from the Rod Control Cabinets during this event were returned to their respective manufacturers for analysis. It was determined that the 10 amp fuse failed due to a small overload, a 30 amp fuse failed due to a bad solder connection, and another 30 amp fuse failed due to an overload. The cause of failure of the trigger indicator could not be determined, but it was speculated that it may have failed due to age.

3. The SCD Pulser/Oscillator circuit card that was removed from

the Logic Cabinet was sent to Westinghouse where it was determined that the cause of failure was a zener diode that had broken down such that it had reduced output.

4. During Unit 2 start-up testing, after refueling, rod control circuitry and rod bank motion were tested and verified to have proper operation.

F. PREVIOUS EVENTS

Previously, at Zion, there was an occurrence where a control rod was dropped due to pulling a fuse because of an erroneous blown fuse indication; this is documented in DVR 22-2-75-229.

There have been three prior occurrences of failed Pulser/Oscillator cards: Two on Unit 1 (DVR's 22-1-79-129 and 22-1-82-135) and one on Unit 2 (DVR 22-2-80-122).

Two occurrences of failed Stationary phase fuses during power operation are recorded for Unit 1 in DVR's 22-1-75-231 and 22-1-84-133: none were found for Unit 2.

G. COMPONENT FAILURE DATA

Manufacturer Nomenclature Model No. Mfg. Part No.

1. Westinghouse Alarm Circuit Card S/N 0076 6050 D13G01
2. Westinghouse Pulser/Oscillator WSN0032 3360C901G01
3. Bussman Fuse, 10 Amp 250v N/A FWX-10
4. Shawmut Fuse, 30 Amp 600v Type 1 A60X30
5. Shawmut Trigger Indicator N/A TI-600

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Zion Generating Station
101 Shiloh Blvd.
Zion, Illinois 60099
Telephone 708 / 746-2084
June 9, 1995

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

The enclosed Supplemental Licensee Event Report number 88-007-01, Docket No. 50-304/DPR-048 from Zion Generating Station is being transmitted to you to update the corrective actions taken.

Very truly yours,

G. K. Schwartz
Station Manager
Zion Generating Station

EAB/sks

Enclosure: Licensee Event Report

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